Rail Event Recorder Maintenance Procedures

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INSTRUMENTATION and CONTROL EQUIPMENT

Code of Federal Regulations 49

229.23 (a) "the interval between any two periodic inspections may not exceed 92 days."

229.25 (e) the event recorder…shall be..maintained…in accordance with…

229.25 (e)(1) …written instructions

229.25 (e)(2) …tested prior to… maintenance

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Code of Federal Regulations 49 229.25(e)

229.25 (e)(2) "the event recorder test shall include cycling all require recording parameters and determining the full range of each parameter by reading out recorded data. A micro-processor based event recorder, equipped to perform self-tests, has passed the pre-maintenance inspection requirement if it has not indicated a failure."

Code of Federal Regulations 49 229.25(e)

229.25 (e)(3) if it fails, record it, fix it

229.25 (e)(4) when successful, a copy of verification data is stored until the next PI

229.25 (e)(5)…periodic maintenance is considered affective if 90% of inbound event recorders are fully functional.

IEEE 1482.1 Self Test Requirements

Program Storage Memory: …at least once every 24 hours, recalculate the check-sum for the used PROM

Data Memory: … each write to non-volatile memory shall be read and verified.

Other Memory: All other memory shall be checked at system start-up and at least once every 24 hours…

Clocks: System clocks shall be continuously checked to ensure that they are operating.

IEEE 1482.1 Self Test Requirements

Processor Exceptions: Processor exceptions shall be trapped…

Watch dog timers: Watch dog timers shall be provided to detect and interrupt program control flow errors.

Input Validity Checks: The system shall test the validity of signal inputs by analysis of normal versus abnormal conditions.

Controlled shut down: The system shall monitor power supply input voltage…a controlled shut down.

Common Ground

CFR "equipped to perform self-tests"

IEEE "self test feature shall evaluate processor operation on a continuous basis and it shall employ recorded signals from train operations…"

Self Testing: Data

Channel Activity – indications of proper activity within the Periodic Inspection Period

Recording Duration – monitoring to ensure that a minimum of 48 hours of data is recorded

Recording Data Rate – create a fault if the current recording rate will result in less than 24 hours of recorded data

Self Testing: Logical Operation

Transducers – inputs beyond operational range (2 mA from a 4-20 mA device)

Illogical Parameters – tractive effort, direction sensing, but no speed input

Redundant Inputs – independent inputs disagreeing (propulsion signals compared with braking signals)

Periodic Test (PI) Basics

Observe ER Fault Indicator.

Review Activity Monitor (if so equipped).

Activate all input channels.

Extract and analyze data:

- Review operational data,
- Review input activity.

PI Fault Indicator

If a fault indicator is active it is imperative that the nature of the fault be determined so that its effect on the recorded data is known.

Proper fault logging and documentation will assist in data analysis and ER maintenance.

PI Activity Monitor

If the ER is configured with an Activity Monitor it may not be necessary to manually activate any input channels as part of the PI. This can significantly reduce the time and effort required to complete the PI.

PI Activate Inputs

Using instructions derived from reviews with the vehicle builder, event recorder manufacturer, and operating authority activate all event recorder input channels.

PI Operational Analysis

The inbound runs should be reviewed against normal operational expectations. Experience is quickly developed to notice abnormal conditions. Further investigations are required to determine root cause (fault or unusual practices).

PI Activity Analysis

If equipped with active Activity Analysis

review the Activity Summary for inactive channels

Else

review the data download for inactive channels.

An inactive channel at this point should be considered a Fault condition.